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RUNNING HEAD: KNOWLEDGE AND ATTITUDES

**Saudi Arabians' Health Beliefs Pertaining to
Middle East Respiratory Syndrome – Coronavirus (MERS-CoV):
Knowledge, Attitudes, and Practices (KAP) Assessment**

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A Public Health (or Health Education) Capstone Thesis Project presented to the faculty of the Department of Medical Science and Community Health, Arcadia University in partial fulfillment of the requirements for the Master of Public Health/Science Degree in Health Education

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Abstract

Background

Middle East Respiratory Syndrome (MERS-CoV) causes respiratory illness and has been linked to high morbidity (N=583) and mortality (N=1359) since it was first found in Saudi Arabia in 2012. Camels have been identified as the likely source of the infection of MERS in Egypt, Qatar, and Saudi Arabia. Currently, there is no available treatment for MERS; however, prevention and education have been established as the best practices for prevention by the World Health Organization, United States (U.S.) Centers for Disease Control and Prevention, and The Ministry of Health in Saudi Arabia.

Purpose

This study explores awareness and health behaviors related to the prevention of MERS among Saudi Arabians in three regions (Jeddah in the western area, Riyadh in the middle area, and Dammam in the eastern area) to assess potential future public health promotion activities.

Methods

A 14-item Likert-scaled survey was administered to Saudi Arabians aged 20 years and older living in three regions (N=90). The survey questions assessed knowledge, attitudes, and practices (KAP) pertaining to the prevention of MERS. A descriptive analysis was conducted, and data were reported as percentages and frequencies and were stratified by sex, age, and geographic region.

Results

Women demonstrated a greater level of knowledge of MERS risk and prevention than men did. Those living in Jeddah had a higher level of prevention knowledge and attitude than did those in other regions of the country.

Conclusion

In general, participants demonstrated a high level of knowledge and attitude toward MERS. However, there were specific geographic areas in which respondents had a lower level of knowledge, thus highlighting the need for targeted education programs and effective intervention with more research efforts. Understanding the knowledge, attitudes, and practices surrounding MERS prevention has implications for general public health research and practice in the area of infection disease prevention.

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Introduction

Middle East respiratory syndrome (MERS), which was first identified in Saudi Arabia in 2012, is a viral disease that causes respiratory illness and leads to a high percentage of mortality (World Health Organization [WHO], 2012). It targets the respiratory system (lungs and breathing tubes). Most patients with MERS have common symptoms, including fever, chills, and cough. Less common symptoms include coughing up blood, diarrhea, and vomiting. However, these symptoms can also occur with a number of other conditions. MERS can affect anyone, including infants, children, men, women, and seniors.

All reports of the disease have been linked to travel to Saudi Arabia or other Middle Eastern countries, including Qatar, the United Arab Emirates, and Oman. However, in 2014, the World Health Organization (WHO) officially reported 209 deaths, with 113 reported from Saudi Arabia. Still, a clear picture about the disease is not known due to the underreporting of cases in Saudi Arabia (Sampathkumar, 2014).

According to the WHO, in 2015, a total of 1,106 laboratory-confirmed cases were reported, including cases from different countries worldwide: 10 countries from the Middle East, two from Africa, eight from Europe, and two from Asia and the United States of America (USA). About 63.5% of the reported cases were males, the median age was 48 years (range of 9 months to 99 years), and about three to four out of every 10 patients with reported cases have died (WHO, 2015).

There is no clear picture on the source of MERS nor a full understanding of the MERS cycle (Sampathkumar, 2014). The mortality rate continues to increase, and there is still no vaccine or effective treatment for controlling the spread of the disease (WHO, 2015). However,

in 2015, cases of MERS were reported in Asia with high morbidity (n=186) and mortality (n=36).

A large outbreak occurred in a hospital in Riyadh, Saudi Arabia, in the summer of 2015 (Ministry of Health [MOH] in Saudi Arabia, 2015). The chart below shows the total number of cases in Saudi Arabia since 2014. The virus does not pass from one human to another in a health care setting or household unless there is close contact, such as that which occurs when providing unprotected care to a patient (California Department of Public Health [CDPH], 2015). Close contact appears to be required for the transmission of the virus, according to the U.S. Centers for Disease Control and Prevention (CDC).

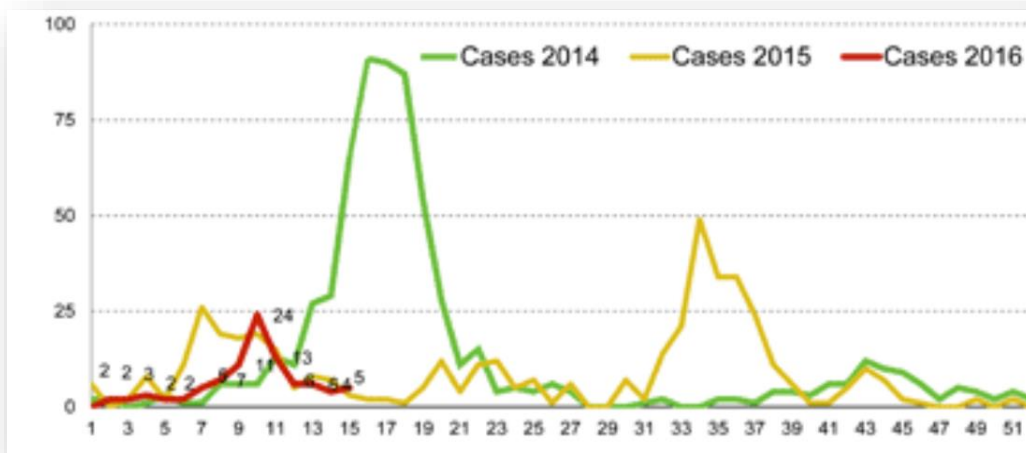


Figure 1. Middle East respiratory syndrome coronavirus (MERS-CoV) cases based on reported data, 2014–1016; Ministry of Health (MOH) in Saudi Arabia, April 15, 2016

There is evidence based on other infectious diseases, such as severe acute respiratory syndrome (SARS), that increasing knowledge and awareness among people about a disease and how they should protect themselves during the outbreak of the disease will help to control the

spread of the disease (Bener, 2004). On the other hand, understanding the public's perception of infectious disease threats would contribute to the ability of the Ministry of Health (MOH) in Saudi Arabia to determine the knowledge gaps that need to be addressed in public health awareness campaigns (Al Mutairi et al., 2015).

The aim of this study was to measure public awareness about MERS among Saudi Arabian people in three regions to determine what factors are related to health promotion.

Hypothesis 1: People living in the Western region will have more knowledge about how to prevent MERS than will those who live in the nation's other regions.

Hypothesis 2: Females will have a higher level of knowledge and attitude compared to males.

Theoretical Foundation

Theory of Planned Behavior

The theory of planned behavior (TPB) is an extension of the theory of reasoned action (TRA) rather than being an independent theory. Both focus on theoretical constructs concerned with individual motivational factors as determinants of the likelihood of performing a specific behavior (Glanz et al., 2002). However, TPB addresses the problem of incomplete volitional control (McKenzie, 2012). Meanwhile, TRA measures the relationship between attitudes and social normative perceptions that determine behavioral intention (Glanz et al., 2002). Like TRA, TPB includes two constructs: **attitude toward behavior** and **subjective norm**; however, it has added the concept of **perceived behavioral control** (McKenzie, 2012). Attitude toward behavior refers to “an individual's positive or negative evaluation of self-performance of the particular behavior” (Glanz et al, 2002, p. 75). Subjective norm refers to an individual's perception of a particular behavior, which is influenced by his or her judgment of significant others (e.g.,

parents, spouses, friends, and teachers) (Amjad, 2009). Ajzen et al. (2011) added perceived behavioral control to TRB based on the idea that behavioral performance is determined by motivation (intention) and ability (behavioral control) (Glanz et al., 2002).

Perceived behavioral control refers to “people’s perceptions of their ability to perform a given behavior” (Glanz et al, 2002, p. 76). In other words, perceived behavioral control is similar to the social cognitive theory’s concept of self-efficacy. As a general rule, the more favorable the attitude and subjective norm are with respect to a behavior, and the greater the perceived behavioral control is, the stronger the individual’s intentions to perform the behavior under consideration should be. McKenzie et al. (2011) mentioned:

There are two important features on this theory. First, perceived behavioral control has motivational implications for intentions. That is, without perceived control, intentions could be minimal even if attitudes toward the behavior and subjective norm were strong. Second, there may be a direct link between perceived behavioral control and behavior. Behavior depends not only on motivation but also on actual control. (p. 165)

Actual behavioral control is a factor of perceived behavioral control and the outcome behavior. Overall, intention is conceptualized as one of the most crucial predictors of how attitude toward behavior, self-efficacy, and beliefs impact intention. The significant components of TPB are how perceived control can impact behavioral intention, which is, in turn, affected by attitude toward behavior and the subjective norms associated with a behavior.

Within this research context, the constructs of TPB, beliefs, attitudes, and self-efficacy are applied for the purpose of measuring people’s knowledge of MERS as well as their behaviors associated with protecting themselves by following safety instructions, such as practicing proper hand hygiene and wearing facemasks. For example, some evidence shows that the camel is the

host of the virus and that it is responsible for the spread of the disease via close contact. Today, social media is used to spread information, but some people refuse to believe what they see on it. Therefore, their belief and bad behaviors impact their intention toward living safely during a MERS epidemic.

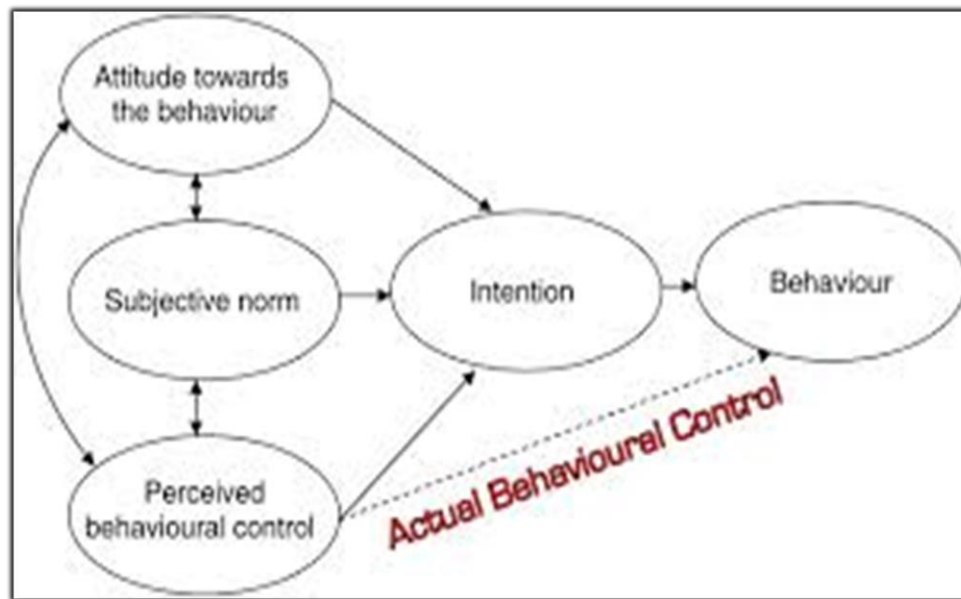


Figure 2. Azjen's theory of planned behavior

Social Ecological Model

Ecological theories are based on the assumption that health behaviors and health status have multiple influences, including intrapersonal, interpersonal, organizational, community, physical, environmental, and policy factors (Sallis, Owen, & Fisher, 2008). Each factor is related to and influences one another. Demographic elements have impacted all levels of the ecological model and are a vital component of health (Link & Phelan, 1995).

Intrapersonal-level factors contain behavior intention, knowledge, skills, perceived risk, self-efficacy, beliefs, and subjective norms (Kincaid, Figueroa, Storey, & Underwood, 2007). Interpersonal factors (also called social network factors) are combined relationships with family and spouses (Kincaid, Figueroa, Storey, & Underwood, 2007). Only the intrapersonal and interpersonal levels were explored through the dialogs and data collection because they could be examined during the research period, unlike the community- and policy-level factors and their impact on the public.

The level of policy regulation is being pursued to ban travel to epidemic areas. For example, in 2014, the U.S. Centers for Disease Control and Prevention provided guidance known as the Interim Infection Prevention and Control Recommendations for Hospitalized Patients with Middle East Respiratory Syndrome Coronavirus (MERS-CoV), which highlighted key infection control recommendations, including standard, contact, and airborne precautions (U.S. Centers for Disease Control and Prevention [CDC], 2014).

The intrapersonal or individual level of the model was applied in this study, and more exactly, relevant concepts, knowledge of MERS, attitudes toward it, beliefs about it, and self-efficacy were discovered to control the risk. Risk perception was also of interest, but both an intrapersonal- and an interpersonal-level factor were considered because it is an individual skill impacted by behavior within one's social network, interpersonal communication, and information seeking. The macro levels, policy/societal and community, are significant for controlling the outbreak of the disease.

Each level in the model is clearly linked and interdependent. Even though the policy/societal level is visualized at the top of the model, the layout of the model indicates that it

is not a traditional hierarchy. Instead, the levels intermingle and impact one another because they exist within one another. The figure below shows the stages of the social ecological model.

Therefore, if/when individuals are exposed to media coverage on the issue, this affects them at the interpersonal level, where they discuss the topic with their peers. In addition, it influences them at the intrapersonal level by increasing their knowledge. As a result of reading a piece on the issue, which is an individual behavior, an individual may have a greater understanding and more knowledge of MERS prevention and control and then share this information with his or her family and community members. This demonstrates how the different levels of the social ecological model impact one another and interact.

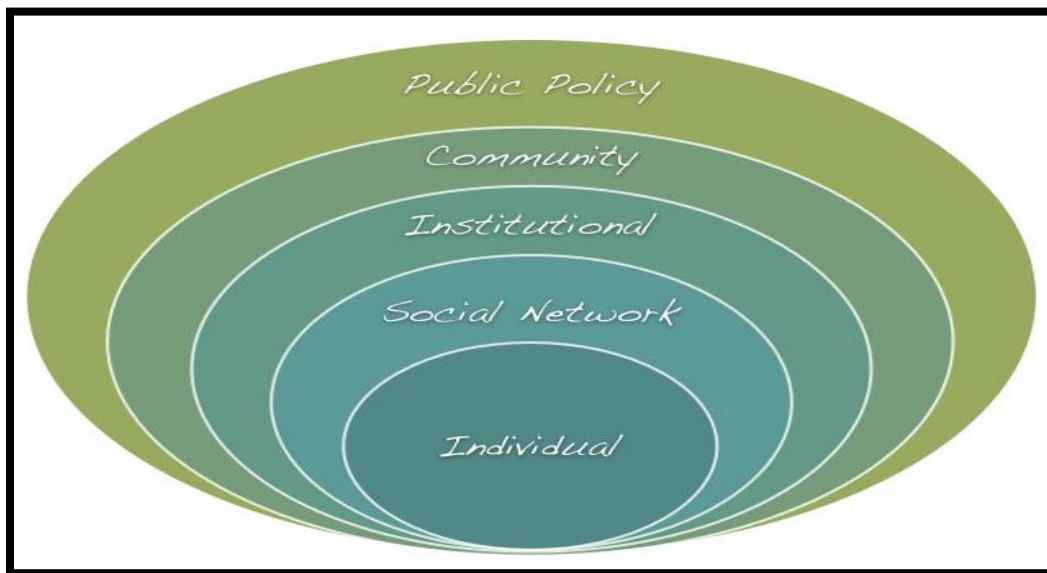


Figure 3. Social ecological model

Literature Review

Overview and Epidemiology of MERS

MERS is a viral disease that causes respiratory illness and leads to a high percentage of mortality. The first appearance of the disease was in the Middle East in 2012. The virus has since been named MERS-CoV.

The first report of a MERS infection was in a 60-year-old Saudi businessman. He was admitted to a private hospital in Jeddah, Saudi Arabia, on June 13, 2012, with a seven-day history of fever, cough, expectoration, and shortness of breath. He had no history of heart disease or renal disease, and he did not smoke. In other words, he was healthy except for his obesity (high body mass index). He developed acute respiratory distress syndrome (ARDS) and acute kidney injury. On day 11 (June 24, 2012), the patient died; MERS was isolated from his sputum (Zaki, 2012).

All reports of MERS have been linked to travel to Saudi Arabia and seven other countries on the Arabian Peninsula, such as Qatar, the United Arab Emirates, Oman, etc. According to the WHO, in 2015, 1,106 laboratory-confirmed cases were reported, including cases from different countries worldwide: 10 countries from the Middle East, two from Africa, eight from Europe, and two from Asia and the USA. About 63.5% of the reported cases were males, the median age was 48 years (range of 9 months to 99 years), and about three to four out of every 10 patients with reported cases have died (WHO, 2015).

According to the California Department of Public Health, fever, cough, chills, and shortness of breath are the early symptoms of MERS. Pneumonia is common as well. Diarrhea, nausea, and vomiting have also been reported in some cases. Other cases tested after people's contact with MERS patients had no symptoms. Severe pneumonia and organ failure are

complications of MERS. As of June 2015, approximately 35–40% of confirmed cases had died. The most severe cases of MERS patients have had underlying chronic medical conditions. There is no known vaccine or specific treatment; management of the disease is supported.

The spread of the disease started in 2012. Virologist Dr. Ali Mohamed Zaki isolated and identified the first case in Saudi Arabia (Zaki, 2012). Three months later, in September 2012, it was reported that a second patient with a history of travel to Saudi Arabia who had been transferred from a hospital in Qatar to a hospital in London was infected with the same virus (Zaki, 2012; WHO, 2012). In addition, another two cases from Jordan were reported, and both patients died (Al-Abdallat, 2014).

In April 2013, a cluster of 23 confirmed cases and 11 probable cases of MERS were detected in Al-Hasa—a city in the eastern region of Saudi Arabia (Assiri, 2013). Then, in June 2014, MERS cases were reported in 22 countries mostly belonging to the Arabian Peninsula (Jalal, 2015). On the other hand, the number of cases reported in Saudi Arabia and the United Arab Emirates increased (Oboho, 2015; WHO, 2015). Furthermore, two cases were reported from the US. The first case was reported from the Indiana Department of Health and involved a health care worker who had lived and worked in Riyadh, Saudi Arabia, but traveled to Indiana in April 2014 (Bialek, 2014). A second case in the US was confirmed in May 2014 in Florida in an individual who was visiting from Saudi (Bialek, 2014).

The next year, in 2015, the first cases appeared in South Korea and China (WHO, 2015). By early July 2015, a total of (n=185) cases had been reported among household and hospital contacts; death was reported in (n=36) of the cases (WHO, 2015). A large outbreak occurred in a hospital in Riyadh, Saudi Arabia, in the summer of 2015 (MOH, 2015). The virus does not pass

from one human to another in a health care setting or household unless there is close contact, such as that which occurs when providing unprotected care to a patient (CDPH, 2015).

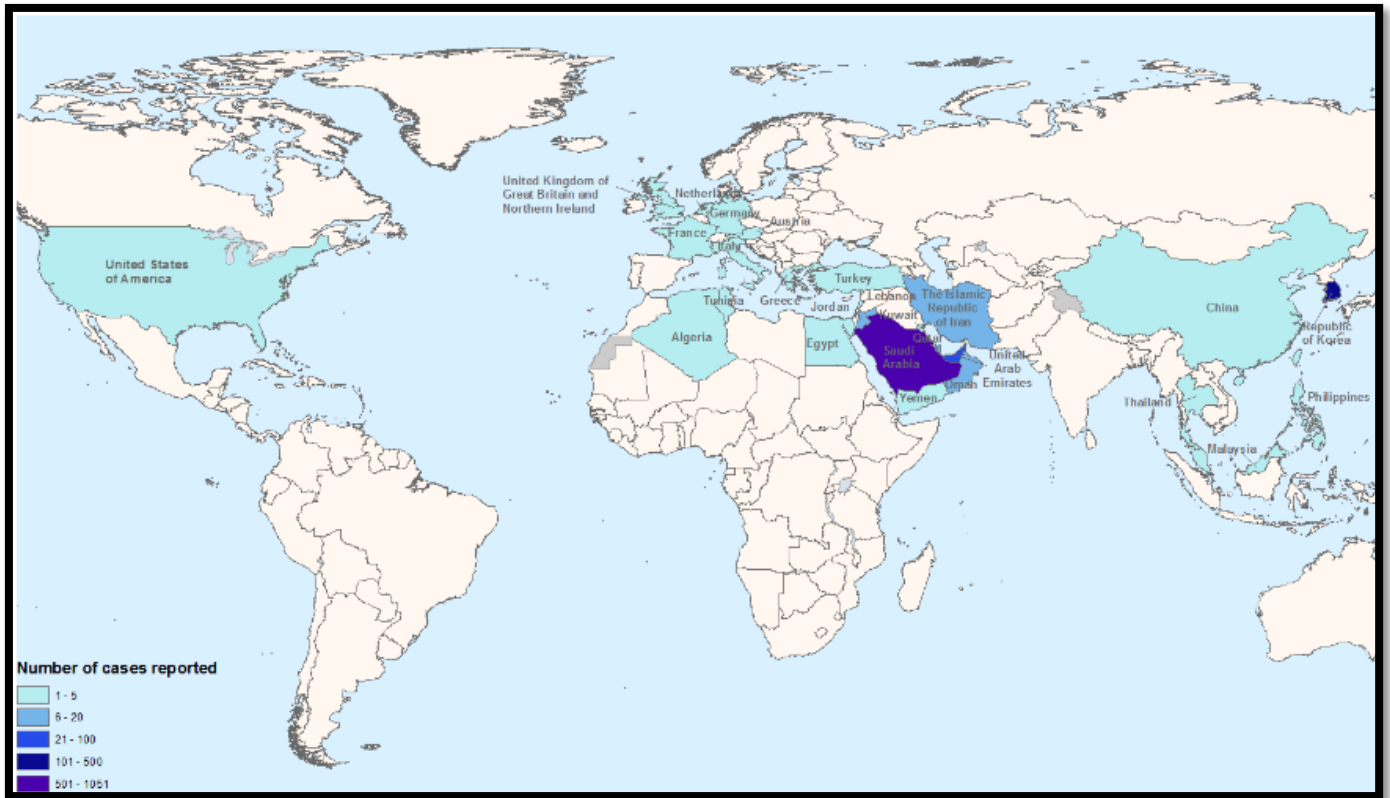


Figure 4. World map of Middle East respiratory syndrome (MERS) reported in 2015 (World Health Organization [WHO])

Transmission of MERS-Co V

There is neither a clear picture on the source of MERS nor a full understanding of the MERS cycle. Some studies suggest that, for many years, the virus had been circulating in bats. However, MERS has been isolated from dromedary camels in Egypt, Qatar, and Saudi Arabia, which has led to the thinking that these camels are a potential source of coronavirus infection. Many cases report no contact with camels at all, however, suggesting that there may be another environmental source (Sampathkumar, 2014).

The transmission of the coronavirus from animals to humans is not fully understood. It is believed that humans become infected through direct or indirect contact with animals. Sciences specifically need to know how people get infected with MERS by camels in the Middle East. The coronavirus may have first appeared in animals in July 2011 and then infected people multiple times. People then transmitted the virus to others. The illness called MERS was identified last year and has sickened (n=132) and led to (n=58) deaths, mostly in Saudi Arabia. Bats and camels are both possible carriers of the coronavirus that causes the disease, but neither is the definitive animal source of human infections (Saey, n.d.). There is some relevant evidence in a study done by Azhar et al.; they suggested that a high mortality of human cases involving MERS infection was transmitted through close contact with an infected camel (Azhar et al., 2016). However, in a study done in Al Hasa, Saudi Arabia, it was determined that camels are not guilty of the transfer of the coronavirus. Therefore, the idea of transmission from camels to humans as the cause of MERS is not a very strong one. On the other hand, when a person becomes infected with the virus, it is easy for him or her to transfer it to another person through close contact, such as through receiving care from or living with the other person. In addition, infected people have spread MERS to others in health care settings, such as hospitals (National

Institutes of Health [NIH], 2015), and the coronavirus may be associated with considerable morbidity (Assiri, 2013). The vast majority of the cases have been reported from outbreaks in hospitals: 255 cases in Jeddah and 45 cases in Riyadh (WHO, 2014).

“Because of coronaviruses have the ability to infect multiple species and to rapidly change through recombination, they present a serious human health threat” (Sampathkumar, 2014, p. 1155). In addition, people who have prior health conditions, such as, diabetes, renal failure, chronic lung disease, and immunocompromised persons are considered to be at high risk of getting MERS infection. Consequently, these people should avoid close contact with animals, particularly camels, when visiting farms, markets, or barn areas where the virus is known to be potentially circulating (WHO, 2015).

As mentioned earlier, close contact appears to be required for transmission of the virus. According to the CDC, close contact is defined as being within about six feet (two meters) or within the room for an extended period of time while not wearing recommended personal protective equipment, such as gloves, gowns, respirators, and eye protection, or having direct contact with infectious secretions while not wearing recommended personal protective equipment. Health care workers and households/those living with infected persons seem to be in the top for those who have a high risk of getting the infection.

In one outbreak, the index case was a 70-year-old man with diabetes and renal failure.

Two of his sons who were smokers and a grandson who had no comorbidities developed MERS infection and required hospitalization; one person died. All the cases lived in the same household and ate meals together. (Sampathkumar, 2014, p. 1155)

Most reported cases have been linked to person-to-person exposure:

Most of them in the hem in hemodialysis (nine cases) or intensive care (four cases) units of a single hospital. There were only two proven cases in healthcare workers, and only three family members (all of whom had visited the hospital) were proven infected despite a survey of over 200 household contacts. (Assiri, 2013, p. 410)

Common MERS symptoms include the prodromal symptoms of fever, myalgia, and headache for the first 3–7 days, followed by respiratory symptoms, including non-productive cough and shortness of breath and eventually progressing respiratory and kidney failure. Almost 40% of those infected do not survive the disease, with the rest requiring intensive care unit (ICU) admission, mechanical ventilation, and dialysis (Jalal, 2015).

Treatment of MERS-CoV

Medical treatment. This includes, first, mechanical ventilation and renal replacement therapy. Second, it includes the combination of ribavirin and interferon alfa-2b therapy. However, in Saudi Arabia, five critically ill patients who received the ribavirin and interferon therapy have died (Sampathkumar, 2014).

Interim home care and isolation. The CDC stated that ill people who are being examined for MERS infection and do not need to be in a hospital may be cared for and isolated in their homes (Kharma et al., 2015).

Avoiding camels. The WHO recommended that individuals who are at high risk of chronic disease, such as prolonged lung disease, immunocompromised hosts, diabetes, or renal failure, should take precautions when visiting places where camels are present—for example, farms, camel coops, and barn areas. These precautions include practicing good public health measures, such as good hand hygiene, avoiding direct contact with camels, avoiding drinking raw camel milk or camel urine, avoiding eating meat that has not been perfectly cooked, and

avoiding eating food that may be contaminated with animal discharge or products that are not washed appropriately (Khurma et al., 201).

Knowledge and Attitude among the Public in Saudi Arabia about MERS

Many studies have been done about infectious diseases, such as SARS, avian influenza, and the influenza strain H1N1 to measure people's knowledge, attitudes, and practices. Regarding MERS, most studies have been designed to assess the Hajj Pilgrims' knowledge (Tashani, 2014), and one study examined the infectious disease knowledge among the public in Saudi Arabia (Almutairi et al., 2015). There is evidence based on other infectious diseases (e.g., SARS) that increasing knowledge and awareness among people about a disease and how they should protect themselves during the outbreak of the disease will help to control the spread of the disease (Bener, 2004). Furthermore, understanding the public's perception of infectious disease threats would contribute to the MOH's ability to determine the knowledge gaps that need to be addressed in public health awareness campaigns (Al Mutairi et al., 2015).

A recent study conducted at King Saud University in Riyadh detected more than 1,000 participants, both male and female, in shopping malls. The vast majority of the population showed limited knowledge of MERS. About 91% were aware that Middle East respiratory syndrome is a viral illness. However, approximately 48% of the participants "mistakenly believed that disease was an immunodeficiency disease" (p. 335). More than 50% knew that the symptoms of the disease are similar to seasonal flu symptoms and that this illness could lead to death. Unfortunately, more than half of all of the participants were confused about their knowledge regarding the period of communicability and the incubation period (Al Mutairi et al, 2015). However, Almutairi et al. (2015) said:

The occurrence MERS infection had an emotional impact and also increased people's attention to preventive measures and their knowledge about the necessity of early access to health care. Information and education delivery need to take into account the local conditions and the population. (p. 336)

The problem of MERS infection becomes more complicated in the absence of any vaccines or curative treatment as well as with a lack of experience in controlling the spread of the disease. A good understanding of the public health implications of the emergence of this new respiratory virus from the Arabian Peninsula is needed to understand the exposure risks. In addition, the current situation needs to be monitored carefully, as there is a fear stemming from the increased number of human infections and deaths, especially during the Umrah and Hajj seasons, where hundreds of thousands of individuals from all around the world pour into the Holy Places in Saudi Arabia (Makkah and Madinah) through the City of Jeddah, where many cases have been identified. One of the risk factors identified in the reported cases was visiting a health care setting in Makkah. One study:

Targeted healthcare providers in Makkah hospitals by assessing their knowledge, attitude and practices (KAP) towards MERS. They are considered a high risk group through direct contact with the suspected cases of infection during Umrah and Hajj season. Also they are expected to have an essential participation in health education activities towards the infection. (p. 104)

In this study was a significant positive association between knowledge and both attitude and practice scores. The knowledge was more significant among those older than 30 years ($P = 0.002$), physicians ($P < 0.001$), and those with more than 10 years of experience ($P = 0.008$), and the mean practice score was significantly higher among females. In the study, one-third of the

sample had good knowledge and the rest had poor knowledge in response to questions regarding the reservoir of infection (49.5%), methods of transmission of the infection to humans (31.0%), transmission through renal dialysis (58.7%), characteristics of Saudis' infected cases (36.0%), and the incubation period in humans (40.9%). In general, most of the sample size had a negative attitude, and about 8% had a positive attitude. However, a good explanation for a low level of attitude regarding MERS infection is that the participants were health care workers with no previous experience or exposure to such cases.

One study done in Al Qassim had a different finding from that of the Makkah study. This study's findings showed that health care workers in the Al Qassim region of Saudi Arabia have good knowledge of and a positive attitude toward MERS. The aim of this study was to assess health care workers for their knowledge of and attitude toward MERS in Saudi Arabia. The cross-sectional study involved two hospitals in the Al Qassim region, and (n=280) health care workers participated in this study. Knowledge and attitude were measured by using a questionnaire. Overall, the participants offered good knowledge and a positive attitude toward MERS. There was a significant correlation between knowledge and attitude. However, health care workers were less educated about the management (42.4%), source (66%), and consequences of MERS (67.3%). Still, a vast majority of the participants were aware of the symptoms, precautionary measures, and hygiene issues. The majority of respondents showed a positive attitude toward the use of protective measures. In addition, gender and experience played a role in determining knowledge and attitude.

A study was also done in the western area of Saudi Arabia—specifically, in Jeddah. However, this study was different from the previous study because it was an assessment of the awareness level of dental students toward Middle East respiratory syndrome. It aimed to improve

the knowledge of the dental students and to evaluate their awareness of MERS. The study participants were recruited from among the dental students of Al-Farabi College, Jeddah. They completed a survey with 12 questions. There were 200 respondents in this study. The result was very good in general; dental students had good knowledge of and a positive attitude toward MERS.

About 44% of respondents knew the definition of MERS and that MERS is an airborne pathogen, 54% recognized the symptoms, and 48% realized that the probable source of MERS virus is camels, while 64% were aware about the way of spreading by close contact and 79% had knowledge of instructions and measures for protection. (p. 164)

The participants considered the air bone to be a major route of MERS transmission. Furthermore, 64% of the participants responded that close contact with a MERS patient is one of the main routes of the spread of the virus. In the study, a high quantity (79%) of respondents were aware of related protection instructions. Kharma et al. agreed that more information still needs to be provided by MOH and the college for the medical staff (Kharma et al, 2015).

Generally, the common finding from previous studies is that different participants have undergone different procedures. The role of the government should be to isolate patients with the coronavirus in special hospitals (86.2% of the participants agreed with this), avoid inviting workers from areas where the disease is prevalent, limit travel to and from suspicion areas (48.3%), and be ready to close schools if the number of cases increases (77.4%). Furthermore, about 25 percent of the participants chose not to travel during the epidemic, instead staying at home (Almutairi et al., 2015).

Hand hygiene is considered to be the most effective measure for preventing microbial pathogen cross-transmission and health care-associated infections (Whitby, 2007). In addition,

94% of people reported the importance of handwashing and wearing facemasks in crowded places (Almutairi et al., 2015).

Thus, “educational programs conducted by health care providers might be effective, but the attitudes of local community must be taken into consideration when planning health education in communities with MERS” (Almutairi et al., 2015, p. 337). As stated earlier, furthermore, it has been documented that understanding the public’s perception of infectious disease threats would contribute to the ability of the MOH to determine the knowledge gaps that need to be addressed in public health awareness campaigns (Almutairi et al, 2015).

Methods

Study Population and Sampling

This study involved (n=90) participants male and female who were 20 years old and above in Saudi Arabia, including 30 from the western area (Jeddah), 30 from the middle area (Riyadh), and 30 from the eastern area (Dammam). A snowball method of sampling was used to reach up to 90 participants, starting with six health workers, working at King Fahad Hospital in Dammam and Riyadh as well as King Abdul-Aziz Hospital in Jeddah. Those six health workers initially contacted to complete the survey and sent it on to others known in the defined regions under study.

Data Collection

Participants who had the WhatsApp application received a link by text message (WhatsApp) to take a survey via an online Arcadia University Survey Monkey. The principal investigator (PI) sent a text message to six individual health workers whose identities were known, with each region referenced above being represented by two participants. Each participant was in charge of sending the survey to other participants via WhatsApp. The text

message asked participants if they would like to take the survey. If so, they were prompted to send a text message containing the survey to other people who had the WhatsApp application.

The format can be seen in Appendix A.

One participant agreed to continue the questionnaire, answering 12 quantitative questions and two qualitative questions. The questionnaire was designed to collect sociodemographic characteristics, such as age, gender, and where they were living, in the first section. There were also eight multiple-choice questions; the questions examined the participants' knowledge of MERS. The last section addressed their attitude toward MERS, with three questions including a yes/no question and then two open-ended questions. Some questions followed a previous survey (Kharma et al., 2015). (Please see Appendix C.)

The knowledge part was assessed by six statements to which the participants responded with "yes" or "no," as well as two multiple-choice questions. A scoring system was applied to assess the level of knowledge of each subject: One point was given for each correct answer. No point was given for an incorrect answer. Participants who answered six or more correct answers were categorized as having good knowledge, and those who answered fewer than six were categorized as having low knowledge.

Data Analysis

Data entry and statistical analysis were performed using Epi Info™ (Version 7.1.5). A descriptive analysis was conducted and data were reported as percentages and frequencies. Numbers and percentages were used for qualitative variables. The chi-square test was used to address the association between knowledge and geographic location as well as knowledge and gender.

Ethical Approval

The study was approved by the Committee for the Protection of Research Subjects, Institutional Review Board at Arcadia University (Appendix D). Furthermore, the participants received a message indicating that a survey was available, and they clicked the link below the message. The consent form (Appendix B) appeared as soon as the participant clicked the link. Then, at the bottom, they clicked the “next bottom” option for the study. If they agreed, they went directly to the survey (Appendix C). The message explained that they could choose not to participate in the survey. In addition, they could choose to leave a question blank if they would rather not answer it, and they could exit the survey at any time by clicking the box at the top right of the page. If they clicked that they agreed to participate in the study, prospective participants were directed to the question form. However, if potential participants stated that they disagreed and wanted to leave the study, they were redirected to the Arcadia University homepage.

Results

Sociodemographic Characteristics

A total of 90 participants (70 female and 20 male) conducted the survey. The vast majority of the participants were between the ages of 20 to 29 years (56.67%). About one-quarter were between 30 and 39 years (24.44%); 14.44% of the participants were aged 40 to 49, and less than 5% of the participants were 50 years or older. Table 1 provides sociodemographic data of the sample.

Table 1, Distribution of Public According to Sociodemographic Characteristics

		Geographic Region in Saudi Arabia					
		East (N=30)		West (N=30)		Middle (N=30)	
Age		Female	Male	Female	Male	Female	Male
(N=90)		(N=26)	(N=4)	(N=25)	(N=4)	(N=19)	(N=12)
20-29 y	No.	17	1	16	1	9	6
	(N=50)	40.48%	20%	30.95%	20%	28.57%	60%
30-39 y	No.	6	1	3	1	7	4
	(N=22)	42.8 %	12.5 %	28.57%	0.00 %	28.57%	87.5 %
40-49 y	No.	3	1	5	2	1	2
	(N=14)	25 %	12.5 %	62.5 %	66.67 %	12.5 %	33.33 %
≥ 50 y	No.	0	1	1	0	2	0
	(N=4)	0.00 %	33.33 %	33.33 %	0.00 %	40%	0.00%

Knowledge

Knowledge related to MERS according to different geographic locations.

The main source of getting information about MERS was the Internet and social media (44 %). Also, consultation with a doctor was the second choice (25%). Twenty percent of the respondents said they learned about MERS through their social communities, such as through friends or family members. Less than 17% of the participants reported newspapers as a source for getting information about MERS. Not a single person depended on television for obtaining information related to MERS.

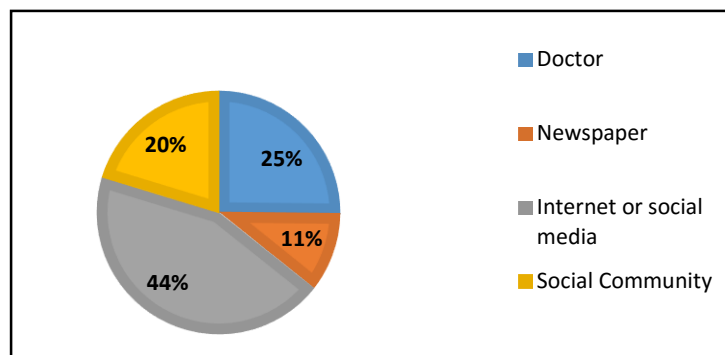


Figure 5. Source of Middle East respiratory syndrome (MERS) information among public

The overall results about the knowledge of MERS with regard to geographic location are reported in Table 2. The majority of the participants from all three regions ($\geq 80\%$) were aware that MERS is a viral disease and is contagious. However, most participants from the western region (63%) thought that having a prior health condition, such as heart disease or diabetes, could raise the risk of getting MERS. Unlike the western region, 20% of the participants from the eastern region thought that having a prior health condition could not raise the risk of getting MERS; some of the participants from the middle region (16%), western region (13%), and eastern region (40%) were unsure about the answer. Most reported that the source of the MERS virus was camels from the middle region (63.3%). In addition, 16% from the western region

stated that humans are the source of the MERS virus, and half of the participants (50%) from the eastern region were unsure about the source of the virus. Of all of the participants, 37.5% from the western region agreed that close contact is the potential mode of transferring the MERS virus, while 38.4% from the western and middle regions believed that contact with infected camels is the way to get the MERS virus. Also, the same results were found for consuming meat or camels' milk. Apart from MERS treatment, 33% of the participants in the western region believed there was no treatment for MERS; however, half of the participants in the western region and the middle region believed that supportive treatment could play a role in being healed of MERS, and 30% of the eastern-region participants believed in the existence of a vaccine for preventing and treating MERS. The majority of participants believed there was no way to treat MERS at home. Approximately 13.3% of the participants from the western and middle regions believed MERS could be treated at home, and 23% of the participants from the eastern region were uncertain about being able to receive MERS treatment at home. All participants from the middle region believed that health education could help to prevent the disease.

In general, participants from the western region (53.3 %) selected the most correct answer, followed by the middle region (40%) and then the eastern region (26.6%). However, there was no significant association between geographic location and MERS knowledge (p -value =4.444), according to a chi-square test for association that was conducted between geographic location and knowledge of MERS (for participants who got scores ≥ 6). All expected cell frequencies were greater than five.

Table 2, Knowledge among Participants toward Middle East Respiratory Syndrome (MERS) According to Geographic Location

		Geographic Region in Saudi Arabia								
		West (N=30)			East (N=30)			Middle (N=30)		
		Yes	NO	Not sure	Yes	No	Not sure	Yes	No	Not sure
MERS contagious		93.3% (N=28)		6.6 % (n=2)	80% (n=24)		20% (N=6)	90% (n=27)		10 % (N=3)
Risk of getting MERS		63.3 % (N=19)	23.3% (N=7)	13.3% (N=4)	40% (N=12)	20% (N=6)	40% (N=12)	56.6% (N=17)	26.6% (N=8)	16.6 % (N=5)
Source of MERS	Camels	56.6% (N=17)		16.6% (N=5)	40% (N=12)	50% (N=15)	63.33% (N=19)		20% (N=6)	
	Humans	16.6% (N=5)	10% (N=3)		3% (N=1)					
	Contaminated water or food	10% (N=3)	0% (N=0)		13.3% (N=4)					
Mode of spread MERS virus	Close contact	37.5% (N=24)			28.1% (N=18)		34.3% (N=22)			
	Contact with an infected camel	38.4% (N=10)		27.7% (N=5)	23% (N=6)		38.8% (N=7)	38.4% (N=10)	33% (N=6)	
	Drinking camel milk or eating camel meat	38.4% (N=10)			30.7% (N=8)			30.7% (N=8)		
MERS treatment	No treatment	33% (N=10)		10% (N=3)	30% (N=9)		30% (N=9)		3% (N=1)	
	Supportive treatment	50% (N=15)	41.38% (N=12)		50% (N=15)					
	Vaccination	6.6% (N=2)	30% (N=9)		16% (N=5)					
MERS treated at home		13.3% (N=4)	80% (N=24)	6.6% (N=2)	0.0 %	76.67% (N=23)	23.3% (N=7)	13.3 % (N=4)	66.6% (N=20)	20% (N=6)
Does education program help?		96.6% (N=29)	3.3% (N=1)		96.6% (N=29)	3.3% (N=1)		100% (N=30)	0.0%	

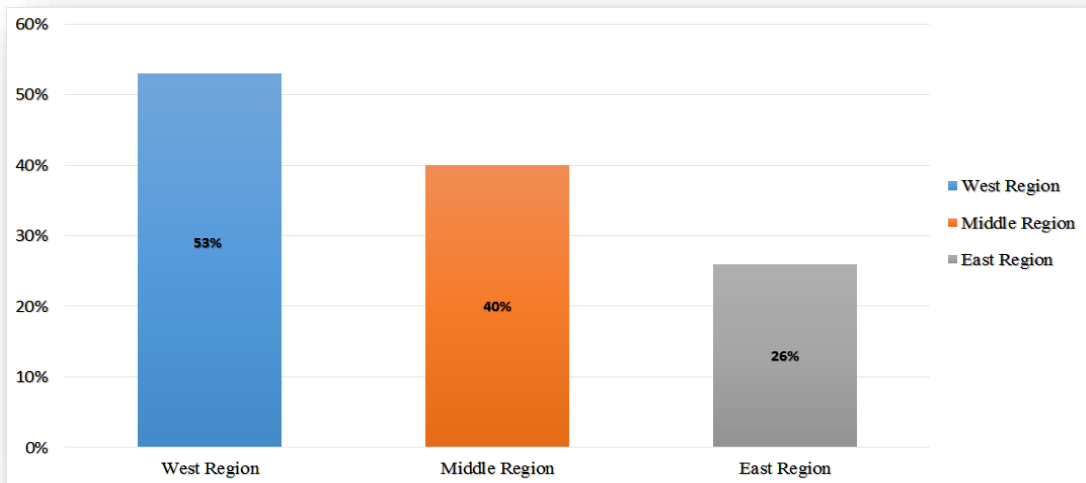


Figure 6, the difference of knowledge among public in three regions in Saudi Arabia.

Knowledge related to MERS with regard to gender. The overall results about knowledge of MERS with regard to gender are reported in Table 3. The majority of male participants (90%) believed that MERS is a contagious disease, while 87% of females held this belief. Half of the male participants agreed that having a prior health condition, such as heart disease or diabetes, could increase the risk of getting MERS, and about 54% agreed among female participants. Camels were ranked as the most likely source of the MERS virus among half of the male and female participants, followed by humans, and finally by contaminated water or food.

Close contact had a high response (76.5%) among females, followed by drinking camels' milk or eating camels' meat (84.6%), and then contact with an infected camel (73%). Unlike females, 26% of the male participants responded that contact with an infected camel is a mode of

the transfer of the MERS virus, and 15% believed that drinking camels' milk or eating camels' meat is a mode of the transfer of the MERS virus. Forty-one percent of male and female participants believed that supportive treatment could help to provide healing for those with MERS. In addition, 21% of the female participants thought there is a vaccine for treating MERS, and 25% of the males and 32% of the females responded that there is no treatment for MERS. The majority of male (65%) and female (77%) participants responded that MERS cannot be treated at home. Furthermore, all male participants (100%) agreed about the role of health education in helping to prevent the disease.

In general, a chi-square test for association was conducted between gender and knowledge of MERS (for participants who got scores ≥ 6). All expected cell frequencies were greater than five. There was no significant association between gender and MERS knowledge (p -value = 0.1957).

Attitude

Prevention practices among Saudi Arabians were measured by three questions. The first question was, "If you knew there was a 2% chance that camels are a source for the transmission of MERS, would you consume camels' milk or meat? Why?" The greatest number of participants (70%) responded with "no," and most said that prevention is preferred versus treatment. One participant stated, "From my responsibility to my family, I should prevent and avoid consuming camels meat or drinking camels' milk even if I do not know for sure that the camels are a source of transmit the virus." A few more participants agreed and added, "Even though 2% is a small number, I will not take a chance."

Table 3

Knowledge among Participants toward MERS According to Gender

		Male (N=20)			Female (N=70)		
		Yes	No	Not sure	Yes	No	Not sure
MERS contagious		90% (N=18)		10% (N=2)	87.1% (N=61)		12.8% (N=9)
Risk of getting MERS		50% (N=10)	30% (N=6)	20% (N=4)	54.2% (N=38)	21.4% (N=15)	24.2% (N=17)
Source of MERS	Camels	50% (N=10)		35% (N=7)	54.2% (N=38)		27% (N=19)
	Human	10% (N=2)			10% (N=7)		
	Contaminated water or food	5% (N=1)			8.5% (N=6)		
Mode of spread of MERS virus	Close contact	23.4% (N=15)		22% (N=4)	76.5% (N=49)		77% (N=14)
	Contact with an infected Camels	26.9% (N=6)			73% (N=19)		
	Drinking camel milk or eating camel meat	15.3% (N=4)			84.6% (N=22)		
MERS treatment	No treatment	25% (N=5)		5% (N=1)	32.8% (N=23)		4.2% (N=3)
	Supportive treatment	41.4% (N=13)			41.4% (N=29)		
	Vaccination	5% (N=1)			21.4% (N=15)		
MERS treated at home		15% (N=3)	65% (N=13)	20% (N=4)	7.1% (N=5)	77.1% (N=54)	15.7% (N=11)
Education help		97.1% (N=68)	2.8% (N=2)		100 % (N=20)		

The rest of the participants (18%) answered “yes” to the question; most participants continued consuming camels’ milk and meat even with the 2% chance that they may be infected. Some stated that, “Cooking is a safe method to kill any virus: sterilization by high temperature.” Another said, “From my studies, there is no evidence or a research confirm that the MERS virus transmit to human by consuming the milk or meat of camels.”

Attitudes Pertaining to Prevention and Self-Treatment of MERS-Co V

Participants took an average of two days to recover from cough or fever at home before they decided to go to the hospital. The vast majority consumed fruits and vegetables in addition to drinking a lot of fluids. Also, they used worm herbal medicine, honey, lemon, vitamin C, and ginger in addition to getting adequate rest. Another participant stated, “I stay at home and drink some medicine or drugs, which I have it before, but if the symptoms include fever I want immediately to hospital.”

Furthermore, participants followed precautionary measures during an epidemic, such as adhering to hygiene, wearing facemasks and gloves, avoiding contact with infected people, and increasing their bodies’ immune systems. In addition, people stated avoiding crowded places. One of the participants commented, “I’m a health care provider, I always wear ‘Personal Protective Equipment [‘PPE’] during working. I would probably wear a mask in public, avoid contact with those who show symptoms, and make sure I have a strong immune system.”

Discussion

The present study measured public awareness about MERS in Saudi Arabia and showed that methods of delivering information and educating people need to take into account geographic location to promote health.

The fact that MERS is airborne makes this disease hard to control. Therefore, the best way to prevent infection is through the promotion of proper sanitation and hygiene (WHO, 2015). The MOH in Saudi Arabia recommended preventive safety instructions, including wearing facemasks and gloves, and frequent handwashing.

The previous study was designed to explore the public's awareness of MERS in Saudi Arabia and to develop an effective strategy for getting the community involved with the MOH to control MERS. A vast majority of the participants were aware of the MERS situation in the country (Almutairi, 2015). In this study, fewer than half of the participants (36 of participants out of 90) had a good level of knowledge of MERS and of how to protect themselves by following precautionary measures. This study illustrated that participants who gained knowledge about MERS were in the western region (16 out of 30), where we got the most correct answers, and then the middle region (12 out of 30), and finally the eastern region (eight out of 30). Furthermore, women (44.2%) had more knowledge than men (25%) did. Moreover, this study was the first study to measure people's awareness and to compare three regions to determine which region needs more education and research.

Knowledge

The majority of the participants in this study depended on the Internet as a source of information about MERS. This result, however, is different from those of previous studies, which showed television as a main source of information for participants (Rapparini et al., 2007).

The result from the study was expected because most of the educational materials (e.g., brochure, flyers, and updates on the situation of MERS) are posted online by the MOH, which encourages the public to use technology. However, caution must be taken when using the Internet as a main source of information to increase one's knowledge, due to information overload. It is difficult to determine the validity of sources of information, which leads to misinformation. Therefore, evaluation skills should be developed among the public with regard to carefully evaluating MERS-related educational materials.

More than half of the participants from the three different regions, regardless of sex, were aware that the MERS virus is contagious and could be fatal. Furthermore, participants from the western region (63%) thought that having a prior health condition, such as heart disease or diabetes, could increase the risk of getting MERS. These results were expected because the first appearance of the disease was in Jeddah (western region) in a 60-year-old man who was suffering from obesity. This man developed ARDS and acute kidney injury, which were fatal (Zaki, 2012). This story in 2012 caused a panic among the public. Therefore, with scientists experimenting to discover the problem, the spread of the disease happened so quickly, and the public started looking forward to a solution. Another possible reason is that the western region has the biggest two historical cities (Makkah and Madinah). Those are important places for Muslims, where millions of pilgrims travel for two mass gatherings annually (Pavli, Tsiodras, & Maltezou, 2014). Therefore, people who visit Saudi Arabia came with knowledge about MERS because their countries put them under educational programs to increase their knowledge of MERS before they came (Tashani, 2014).

Most reported that the source of the MERS virus is camels. This is especially true in the middle region (63.3%) and western region (56%). This is due to the fact that Riyadh and Jeddah

are the two most heavily populated cities, and both cities have a significant camel presence (MOH, 2015). Research has isolated MERS from camels in Egypt, Qatar, and Saudi Arabia, which led to the thinking about camels as being a source of infection of the coronavirus (Sampathkumar, 2014). Moreover, humans themselves could act as a source of transmission of this disease (Hawekes, 2013) by connecting with an infected person or touching her/his tools, such as a cup, plant, and clothes. In addition, close contact can result in the transfer of the disease if a person stays with an infected person in the same place (within two feet). Regarding this question, the knowledge among public requires more clarification. Therefore, it is necessary to cover this gap by educating people about countering the threat of MERS.

Thirty-three percent of participants in the western region believed that there is no treatment for MERS; however, half of the participants in the western region and middle region agreed with using supportive treatment as a treatment for MERS, and 30% of the eastern region participants believed in the existence of a vaccine for preventing and treating MERS. In reality, “there is no treatment, and people healing depended on the immune system for the sick people as well as their psychology,” according to a manager of public health at Ohud Hospital in Madinah (western region). He also added that MERS patients still beg for treatment, so the hospital just gives them ribavirin and interferon. They feel better because they think it is a legitimate treatment, but it is really just a mindfulness-based treatment designed to improve their health and keep their hopes up. In the end, the strength of the immune system is important in overcoming MERS.

Attitude

The general prevention practice among most participants toward MERS was to avoid consuming camels' meat or milk for their families' sakes. On the other hand, 18% agreed with

consuming camels' meat or milk under one condition: "sterilization by high temperature." This is a good strategy for killing the virus, leaving a small chance of getting infected (2%). However, a strategy such as this needs to be improved among the public. Furthermore, there is no study that proves that the MERS virus is transmitted to humans by consuming the milk or meat of camels, but prevention is better than cure.

Regarding the decision of going to the hospital or staying at home among the public when they are coughing or have fevers, two days was the average for participants after trying to boost their immune systems by drinking a lot of fluids at home. The main point is that the existence of a fever led them to run quickly to the hospital. This result shows us that participants have a good knowledge of the symptoms of the disease, particularly a fever persisting for 24 hours. This finding is in agreement with another study that showed a high level of knowledge among the public (Almutairi, 2015) and among health workers (Khan et al., 2014). The perspective of these findings could be because of the focus of education campaigns on the signs and symptoms of MERS, which led to increasing their knowledge in this area.

This study showed a higher level of proper hygienic practices among the public. These results are in line with other studies' findings, which showed the positive attitude of the public (Almutairi, 2015) and among health care professionals specifically (Khan et al., 2014). These implied that precautionary activities to avoid infection by MERS need to be encouraged and strengthened.

Limitations

Previous studies have addressed people's knowledge about MERS; these have largely focused on health care workers. Prior studies have examined knowledge, attitudes, and practices surrounding infectious disease outbreaks, most notably the public's interpretation of SARS.

However, limited studies have looked at the public's knowledge and attitudes about MERS in Saudi Arabia.

A chi-square test identified predictors of gender and geographic location. The result indicated that gender is not a significant predictor of knowledge, whereas geographic location is also not a significant predictor of knowledge. Thus, educational programs conducted by health care providers might be effective, but the attitudes of the local community must be taken into consideration when planning health education in communities with MERS.

This survey detected males and females, but the result did not feature enough males to represent the population (20 males vs. 70 females). In addition, a total of 90 participants represents a small simple size for presenting the Saudi Arabian population.

Conclusions

In general, participants demonstrated a high level of knowledge and prevention toward MERS. However, there were specific geographic regions in which respondents had decreased knowledge, thus highlighting the need for targeted education programs and effective intervention with more research efforts. Understanding the knowledge, attitudes, and practices surrounding MERS prevention has implications for public health research and practice in the area of infection disease prevention more generally.

References

- Al-Abdallat, M. M., Payne, D. C., Alqasrawi, S., Rha, B., Tohme, R. A., Abedi, G. R., . . . Gerber, R. (2014). Hospital-associated outbreak of Middle East respiratory syndrome coronavirus: a serologic, epidemiologic, and clinical description. *Clinical Infectious Diseases*, 59(9), 1225–1233.
- Almutairi, K. M., Al Helih, E. M., Moussa, M., Boshaiqah, A. E., Alajilan, A. S., Vinluan, J. M., & Almutairi, A. (2015). Awareness, attitudes, and practices related to coronavirus pandemic among public in Saudi Arabia. *Family & Community Health*, 38(4), 332–340.
- Ajzen, I. (2011). Theory of planned behavior. *Handb Theor Soc Psychol Vol One, 1*, 438.
- Assiri, A., McGeer, A., Perl, T. M., Price, C. S., Al Rabeeah, A. A., Cummings, D. A., . . . & Memish, Z. A. (2013). Hospital outbreak of Middle East respiratory syndrome coronavirus. *New England Journal of Medicine*, 369(5), 407–416.
- Amjad, N., & Wood, A.M. (2009). Identifying and changing the normative beliefs about aggression which lead young Muslim adults to join extremist anti-Semitic groups in Pakistan. *Aggressive Behavior*, 35, 514–519.
- Assiri, A., McGeer, A., Perl, T. M., Price, C. S., Al Rabeeah, A. A., Cummings, D. A., ... & Madani, H. (2013). Hospital outbreak of Middle East respiratory syndrome coronavirus. *New England Journal of Medicine*, 369(5), 407-416.
- Azhar, E. I., El-Kafrawy, S. A., Farraj, S. A., Hassan, A. M., Al-Saeed, M. S., Hashem, A. M., . . . Madani, T. A. (2014). Evidence for camel-to-human transmission of MERS coronavirus. *New England Journal of Medicine*, 370(26), 2499–2505.

- Bener, A., & Al-Khal, A. (2004). Knowledge, attitude and practice towards SARS. *The Journal of the Royal Society for the Promotion of Health*, 124(4), 167-170.
- Bialek S. R , Allen D., Alvarado-Ramy F., Lastname, X. X., Lastname, X. X., Lastname, X. X., ...
Lastname, X. X. (2014). First confirmed cases of Middle East respiratory syndrome coronavirus (MERS-CoV) infection in the United States, updated information on the epidemiology of MERS-CoV infection, and guidance for the public, clinicians, and public health authorities. *Morbidity and Mortality Weekly Report*, 63(issue), 431.
- California Department of Public Health (CDPH). (Year). Article title. Retrieved from <http://www.cdph.ca.gov/programs/immunize/Pages/MERS-CoV.aspx>
- Center for Infectious Disease Research and Policy. (Year). New MERS cases in 3 cities put Saudi Arabia over 1,200. Retrieved from <http://www.cidrap.umn.edu/news-perspective/2015/09/new-mers-cases-3-cities-put-saudi-arabia-over-1200>
- Glanz, K., Rimer, B. K., & Lewis, F. M. (2002). *Health behavior and health education: Theory, research, and practice*. San Francisco: Jossey-Bass.
- Jalal, S. (2015). The emerging threat of MERS. *The Journal of the Pakistan Medical Association*, 65(3), 310–311.
- Kharm, M. Y., Alalwani, M. S., Amer, M. F., Tarakji, B., & Aws, G. (2015). Assessment of the awareness level of dental students toward Middle East respiratory syndrome-coronavirus. *Journal of International Society of Preventive & Community Dentistry*, 5(3), 163.
- Lastname, X. X. (Year). Article title. Retrieved from http://www.uptodate.com/contents/middle-east-respiratory-syndrome-coronavirus?topicKey=ID%2F89705&elapsedTimeMs=11&source=see_link&view=print&displayedView=full

- McKenzie, J. F., Neiger, B. L., & Thackeray, R. (2012). Planning, implementing, & evaluating health promotion programs: A primer (6th ed.). Location: Pearson HE, Inc. Kindle Edition.
- Oboho, I. K., Tomczyk, S. M., Al-Asmari, A. M., Banjar, A. A., Al-Mugti, H., Aloraini, M. S., . . . & Madani, T. A. (2015). 2014 MERS-CoV outbreak in Jeddah—A link to health care facilities. *New England Journal of Medicine*, 372(9), 846–854.
- Pavli, A., Tsiodras, S., & Maltezou, H. C. (2014). Middle East respiratory syndrome coronavirus (MERS-CoV): prevention in travelers. *Travel Medicine and Infectious Disease*, 12(6), 602–608.
- Saey, T. H. News in Brief: MERS virus jumped several times from animals to humans. More than one person caught new illness from bats, camels or other creatures. Publication Title. Retrieved from URL
- Sampathkumar, P. (2014). Middle East respiratory syndrome: What clinicians need to know. In A. A. Editor & B. B. Editor (Eds.), *Mayo clinic proceedings* (Vol. 89, No. 8, pp. 1153–1158). Location: Elsevier.
- Tashani, M., Alfelali, M., Barasheed, O., Fatema, F. N., Alqahtani, A., Rashid, H., & Booy, R. (2014). Australian Hajj pilgrims' knowledge about MERS-CoV and other respiratory infections. *Virologica Sinica*, 29(5), 318–20.
- Whitby, M., Pessoa-Silva, C. L., McLaws, M. L., Allegranzi, B., Sax, H., Larson, E., . . . Pittet, D. (2007). Behavioural considerations for hand hygiene practices: The basic building blocks. *Journal of Hospital Infection*, 65(1), 1–8.
- World Health Organization (WHO). (Year). Middle East respiratory syndrome coronavirus (MERS-CoV): Summary of current situation, literature update and risk assessment—as of 5 February 2015. Retrieved from http://www.who.int/csr/disease/coronavirus_infections/mers-5-february-2015.pdf?ua=1

World Health Organization (WHO). (Year). Novel coronavirus infection in the United Kingdom.

Retrieved from http://www.who.int/csr/don/2012_09_23/en/index.html

Zaki, A. M., Van Boheemen, S., Bestebroer, T. M., Osterhaus, A. D., & Fouchier, R. A. (2012).

Isolation of a novel coronavirus from a man with pneumonia in Saudi

Arabia. *New England Journal of Medicine*, 367(19), 1814–1820.

Appendices

Appendix A

The Format of the WhatsApp Application



Hello,
My name is Zahrah Alnakli. I am conducting a survey to measure the level of knowledge and attitude among Saudi Arabian people about MERS, so if you would like to take the survey, please click the link below.

Appendix B
Informed Consent Form

Informed Consent Form

The purpose of this study is to learn about Saudi Arabians' knowledge, attitudes, and practices surrounding the Middle Eastern respiratory syndrome (MERS-CoV). The researcher believes that the information gained from those potentially exposed to MERS will contribute to programs and policies in Saudi Arabia designed to improve the population's health and wellbeing.

The results of this study may be presented at a professional meeting. It may be published in a professional journal. All data will remain anonymous. If you wish to see a copy of the final work, send a request to zalnakli@arcadia.edu.

You will be filling out an anonymous self-administered survey over approximately the next 10–15 minutes. Once you complete the survey, you will have no other responsibilities for the research being conducted.

By consenting to participate in this survey, you are verifying that you are 20 or above, are a Saudi citizen, and live in one of the three areas of study (western area [Jeddah], middle area (Riyadh), and eastern area [Dammam]).

Names will not be collected in this study. The final published work will include only grouped results, and therefore, it will not be possible to identify individual participants. Surveys and survey data will be collected and kept on a personal, password-protected computer to which only the principal investigator has access. All data will be kept on a password-protected computer for three years after completion of the research study. No personal information will be stored on any participant, and all survey results will be coded with a study identification (ID) number. The data will be destroyed after three years.

The survey questions are of a non-sensitive nature. However, you can skip any questions that you do not want to answer. You will not be penalized in any way for leaving questions blank. There is no financial compensation for participating in this study. Your participation is completely voluntary. You may withdraw at any time.

The study protocol was approved by the Arcadia University Institutional Review Board (IRB). To ensure that this research continues to protect your rights and minimize your risk, the IRB reserves the right to examine and evaluate the data and research protocols involved in this project. If you desire additional information regarding your rights in this study, you may contact the Arcadia University Office of Research Subject Protection at 297-620-4111. If you have additional questions or comments, please contact the principal investigator or faculty advisor: PI: Zahrah Alnakli, zalnakli@arcadia.edu. FA: Julie Tippens, phone: **215-517-2597**; email: tippensj@arcadia.edu

“I have read the consent form. By clicking the box at the bottom of the screen, I agree that I meet all of the inclusion criteria, and I agree to have the information collected from the following survey to be used anonymously in this study. I understand that I can choose to leave a question blank if I would rather not answer it and that I can exit the survey at any time.” If you choose not to participate, click the box that appears at the top right of the page.

Appendix C
Survey Questions

General Information

1. How old are you?
 - 20–29
 - 30–39
 - 40–49
 - 50 or older
2. Sex
 - Male
 - Female
3. Where do you live?
 - Jeddah (western district)
 - Riyadh (middle district)
 - Dammam (eastern district)
 - Other (please specify)

Knowledge

4. What sources do you trust to get information about Middle East respiratory syndrome (MERS)? (Check all that apply.)
 - Doctor
 - Newspaper
 - Internet or social media
 - TV
 - Social community (friends, neighbors)
 - Other
5. Is MERS contagious?*
- Yes
- No
- Unsure
6. Do you think having a prior health condition, such as heart disease or diabetes, could raise the risk of getting MERS?
 - Yes
 - No
 - Unsure
7. What is the source of the MERS virus? *
 - Camels
 - Humans
 - Bats
 - Consuming contaminated water or food
 - Not sure
 - Other
8. How does the virus MERS spread? *
 - From an ill person to another through close contact
 - Through contact with an infected animal

- By drinking camel milk or eating camel meat
 - Unsure
9. How would you describe MERS treatment? *
- Supportive treatment
 - Vaccination
 - Unsure
 - Other (please specify)
10. Do you think the coronavirus infection (MERS) can be treated at home?
- Yes No Unsure
11. Do you think health education can help to prevent the disease?
- Yes
 - No
 - Other (please specify)

Attitude

12. If you knew there was a 2% chance that camels are a source for the transmission of MERS, would you consume camels' milk or meat? Why?
- Yes
 - No
 - Not sure
13. How do you normally treat yourself when you get a cough or fever? How long will it take to go to the hospital?
- Open-ended question
14. List three precautionary measures you follow during an epidemic.
- Open-ended question

*) Kharma et al. (2015)

Appendix D

Institutional Review Board at Arcadia University Approved

Committee for the Protection of Research Subjects
450 S. Easton Rd.
Glenside, PA 19038
INSTITUTIONAL REVIEW BOARD
(Federalwide Assurance # 00000449)



March 22, 2016

Protocol #: 15-11-19

PI: Alnakli

Faculty Advisor: Dr. Tippens

Title: Knowledge and Attitude among Saudi Arabian People about Middle East Respiratory Syndrome (MERS-CoV)

Dear Ms. Alnakli,

Thank you for submission of the requested revisions to the above-referenced Protocol, following Expedited Review by Arcadia University's Institutional Review Board (IRB). Approval was issued on **March 22, 2016** for 1 year. This approval expires on **March 21, 2017, pending the submission of a continuing review report**. This letter constitutes official notification of the Approval, and you are authorized to commence the research as of the date of the Approval.

Under the provisions of Arcadia University's Federal-Wide Assurance for compliance with the Department of Human Health Services Regulations, the principal investigator is directly responsible for submitting to the IRB any change in the research. Note: All changes must be reviewed and approved by the Committee prior to implementation. Unanticipated, unusual, unexpected hazards or adverse events involving risk to the subject or others must be reported immediately to the Committee, giving detail and your assessment of the occurrence.

Note that the Board recommends submitting renewal/continuation applications 30 days prior to expiration in order to allow adequate time for review. **A Progress Report is due annually on the anniversary date of approval or the protocol will be automatically terminated, and a Termination Report will be due at the close of the study.** We wish you the best in your research endeavors.

Sincerely,

Laura Conway, PhD

Co-Chair, Arcadia University Institutional Review Board.

TEL: 215.572.2900

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Easton Road, Glenside, PA

19038-3295

WISDOM TO GROW ON, WORLDS TO EXPLORE